What are reactors?
What are thermal or fast reactors?

Reactors use fission to make electricity rather than burn fossil fuels

A nuclear power plant generates electricity using a "reactor," which is a device designed to use the *fission* process (splitting of atoms) to turn a small amount of mass into energy in a controlled way. Each fission produces energy, neutrons, and waste fission products.

The energy from the fission reaction is removed from the reactor by a coolant to produce steam to drive the turbines of the electric generators. Thus, in a nuclear power plant, fission of nuclear fuel plays the same role as burning of coal, natural gas, or oil plays in fossil fuel power plants.

The neutrons cause more fission reactions.

There are two types of reactors: thermal-spectrum and fast-spectrum, or simply "thermal" or "fast" for short. The difference has to do with the energy level of the neutrons. The Global Nuclear Energy Partnership includes both.

What are thermal reactors?

In a thermal reactor, the neutrons created by *fission* are slowed down, or moderated, before they cause more fission reactions. Thermal reactors typically use a special type of uranium, called "enriched" in the *isotope* uranium-235 and certain isotopes of the *transuranic elements*, called "fissile."

Virtually all of the world's 441 operating nuclear power plants are thermal reactors. Most of these are Light Water Reactors (LWRs), which use water to cool the reactor and to moderate (slow-down) neutrons. The two LWR types, boiling water reactors (BWRs) and pressurized water reactors (PWRs), result from early U.S. reactor development programs. LWRs dominate world nuclear energy because their technology is well proven and they have favorable economics compared to other options currently available.

A thermal-spectrum commercial reactor

What are fast reactors?

In a fast reactor, the neutrons produced by fission are not slowed down (moderated) significantly before they cause more fission reactions. Thus, fast reactors must minimize use of materials, such as water, which slow neutrons. The higher energy neutrons can fission all types of uranium and transuranic elements, rather than only the "fissile" isotopes split in thermal reactors. This allows the fast reactor to transmute (consume) the transuranics efficiently and safely. Thus, fast reactors can extract energy from all types of uranium and all isotopes of the *transuranic elements*. The Global Nuclear Energy Partnership includes a type of fast reactor, the *advanced burner reactor*, which is designed to maximize consumption of transuranic elements. "Burner" in this instance doesn't mean incineration or combustion. It means conversion of transuranics into shorter-lived isotopes.

A fast-spectrum test reactor

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